CLAIMS

What is claimed is:

1.   A method for nearest neighbor edge selection to construct a 3D model from a

5   sequence of 2D images of an object or scene, comprising the steps of:

providing a set of images from different views of the object or scene;

tracking features of the scene among successive images to establish

correspondence between the 2D coordinate positions of a true 3D features as

viewed in each image;

10   generating depth data of the features of the scene from each image of the

sequence, with entries in the data corresponding to the coordinate position of the

feature along a depth axis for each image, with depth measured as a distance

from a camera image plane for that image view;

aligning the depth data in 3D to form vertices of the model;

15   connecting the vertices to form the edges of the model; and

using visibility information from feature track data, original images,

depth data and input edge data to arbitrate among multiple geometrically feasible

vertex connections to construct surface detail of the 3D model.

20   2.   The method of claim 1, wherein the step of tracking includes identifying 2D

feature points from the images of true 3D feature points, and establishing

correspondence of the 2D feature points among a set of images, to generate a 2D

feature track.

3.   The method of claim 2, further comprising projecting the depth data and the 2D

25   feature points into a common 3D world coordinate system.

4.   The method of claim 3, further comprising generating a point cloud for each

feature point from the 3D projection, with each entity of the point cloud corresponding to the projected 2D feature point from a respective image.

5.   The method of claim 4, wherein the step of using includes consolidating the point cloud into one or more vertices, each vertex representing a robust centroid of a portion of the point cloud.

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6.   The method of claim 5, further comprising building a nearest neighbors list that specifies a set of candidate connections for each vertex, the nearest neighbors being other vertices that are visibly near the central vertex.

7.   The method of claim 6, further limiting the near neighbors list to vertices that
10   are close, in 3D, to the central vertex.

8.   The method of claim 6, further comprising pruning a set of near neighbors lists for multiple vertices such that resulting lists correspond to vertex connections that satisfy visibility criteria.

9.   The method of claim 8, wherein the candidate edges and faces for the model are
15   tested for visibility against trusted edge data.

10.   The method of claim 9, wherein the candidate edges and faces for the model are tested for visibility against trusted edge data derived from silhouette edge data.

11.   The method of claim 9, wherein the candidate edges and faces for the model are tested for visibility against trusted edge data derived from 3D edge data.

20   12.   The method of claim 9, wherein the candidate edges and faces for the model are tested for visibility against trusted edge data derived from depth edge data.

13. The method of claim 9, wherein for each candidate surface face, when the face is a polygon or surface patch bounded by three candidate model edges chosen from a set of near neighbor lists, no candidate edge can occlude the view of that face in that view if the face is determined to be completely visible in any original view, and any such occluding edge is pruned from the near neighbor lists.

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14. The method of claim 4, wherein the step of using includes consolidating the point cloud into one or more vertices, each vertex being located within a convex hull of the point cloud and satisfying visibility criteria for each image in which the corresponding true 3D feature is visible.

10 15. The method of claim 4, wherein the step of using includes projecting a set of pint clouds into a multitude of shared views, a shared view being an original image view that contributes 2D feature points to each point cloud in the set, and projecting vertices derived from each point cloud in the set into the shared views, and the step of using requires the 2D arrangement of the projected

15 vertices, in each shared view, being consistent with the 2D arrangement of the contributing 2D feature points from that view.

16. The method of claim 1, wherein each entry of the depth data is the distance from a corresponding 3D feature point to the camera image plane for a given camera view of the true 3D feature point.

20 17. The method of claim 1, wherein the depth data is provided as input data.

18. The method of claim 1, wherein the depth data is provided as intermediate data.

19. The method of claim 1, wherein the depth data is obtained from a laser sensing system.

20.   The method of claim 1, wherein the depth data is obtained from a sonar sensing system.

21.   The method of claim 1, wherein the depth data is obtained from an IR-based sensing system.

5   22.   The method of claim 1, wherein the 2D feature tracking data is provided as input data.

23.   The method of claim 1, further comprising the step of providing vertex position data as input data.

24.   The method of claim 1, further comprising the step of providing depth edge data
10   as input data.

25.   The method of claim 1, further comprising the step of providing silhouette edge data as input data.

26.   The method of claim 1, further comprising the step of providing 3D edge data as input data.